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METHOD AND APPARATUS FOR DYNAMIC PACKET TRANSPORT IN CDMA2000 NETWORKS

FIELD OF THE INVENTION

The present invention relates to a method and apparatus for sending reverse and forward link data from and to a mobile device, and more specifically for sending reverse and forward link data without establishing a dedicated data Traffic Channel.

BACKGROUND

Wireless data devices are well known in the art. These devices provide a user with the capability of utilizing data services such as e-mails, browsers, or short message services (SMS). These devices further allow the use of data services wirelessly and while mobile.

In current CDMA 2000 networks, data packets are always sent out on a dedicated data Traffic Channel. On power-up of the wireless device, this Traffic Channel is obtained by attempting to obtain a valid Internet protocol (IP) address from a network. The device does this by attempting to establish a dedicated data Traffic Channel and then a point-to-point protocol (PPP) session. Once the device is assigned a valid IP address, the device is allowed to send or receive Packet Data through the Internet routed by the public data serving node (PDSN).

If no Packet Data is sent or received by the wireless data device within a certain time period, the device or the network releases the dedicated Traffic Channel assigned to the device. The PPP session is still kept even after the Traffic Channel is released. At this point, the device goes into a dormant state and stays in this dormant state until a new data packet is sent or received. When a new data packet is sent or received, the device re-establishes the dedicated Traffic Channel in order to send or receive any new data packet.

Always sending and receiving Packet Data on dedicated data Traffic Channels is not efficient with regards to both network resources and battery life of the data device. Network resources are wasted by having a dedicated data Traffic Channel for each wireless device. If the wireless device only occasionally sends or receives Packet Data, a dedicated data Traffic Channel may need to be established and kept for each outgoing or incoming packet.

With regards to the battery life of the wireless data device, the establishment of a dedicated data Traffic Channel involves call processing messages exchanged between the device and the network. This costs the device battery life to establish the dedicated data Traffic Channel. Further, keeping a data Traffic Channel up also requires more transmission power, which also affects the battery life.

A further problem with current CDMA 2000 networks is that they do not support simultaneous voice and data services. A device is not allowed to send or receive data packets when the device has already established dedicated voice Traffic Channel from its dormant state.

SUMMARY OF THE INVENTION

The present invention seeks to overcome the deficiencies in the prior art by providing a method and apparatus for reverse and forward link dynamic packet transport without the establishment of a dedicated data Traffic Channel. Specifically, the present invention allows for the sending of data in the form of a Data Burst Message along either the reverse access channel or within a dedicated Traffic Channel, such as a voice traffic channel.

CDMA 2000 networks provide the frame transport capability of sending short packets on the reverse access channel. The capability of the reverse access channel is broadcast on the Paging Channel with the Access Primary messages. The wireless device can therefore send data packets on this reverse Access

Channel within the maximum transport capabilities of this reverse Access Channel.

Alternately, a data packet can be encapsulated as a Data Burst Message within a dedicated Traffic Channel, such as the voice traffic channel. The capability of the voice Traffic Channel is known to the wireless device and, as long as the data packet is within the voice Traffic Channel maximum transport capability, it can be sent as a Data Burst Message.

Further, a forward link message can be forwarded as a Data Burst Message. When the PDSN receives a data packet, it checks the packet size. If the packet is small enough to transport on the forward common cannel (e.g. Page Channel), the PDSN sends the packet data in a Data Burst Message adding a header for the Data Burst as “Packet Data”.

The present invention therefore provides a method for reverse link dynamic packet transport from a wireless data device in a CDMA2000 network, said method comprising the steps of: determining a frame transport capability of a reverse access channel; checking whether a data packet falls within said frame transport capability; and if said data packet falls within said frame transport capability encapsulating said data packet as a data burst message; sending said data burst message over said reverse access channel; receiving said data burst message at a base station controller; and reforming said data packet.

The present invention further provides a method for reverse link dynamic packet transport from a wireless data device in a CDMA2000 network in which a dedicated traffic channel is established , said method comprising the steps of: determining whether said dedicated traffic channel supports data transmission; if said dedicated traffic channel supports data transmission, determining a frame transport capability of said dedicated traffic channel; checking whether a data packet falls within said frame transport capability; and if said data packet falls within said frame transport capability encapsulating said data packet as a data burst message; sending said data burst message over said dedicated traffic channel; receiving said data burst message at a base station controller; and reforming said data packet.

The present invention still further provides an apparatus for reverse link dynamic packet transport in a CDMA2000 network, said apparatus comprising: a wireless data device including: means to check a data packet transport capability of a reverse access channel; means to check a data packet to determine whether if falls within said data packet transport capacity; means to encapsulate a data packet as a burst data message; and a transmitter to send said burst data message over said reverse access channel; a base station controller including: a receiver for receiving said data burst message; a means to check whether said data burst message is packet data; and a means for forwarding said data burst message to a packet data serving node if said data burst message is packet data; and a packet data serving node, including: a means to reform said data packet wherein said wireless data device can dynamically send said data packet over said reverse access channel.

The present invention yet further provides an apparatus for reverse link dynamic packet transport in a CDMA2000 network, said apparatus comprising: a wireless data device including: means to check a data packet transport capability of a dedicated traffic channel; means to check a data packet to determine whether if falls within said data packet transport capacity; means to encapsulate a data packet as a burst data message; and a transmitter to send said burst data message over said dedicated traffic channel; a base station controller including: a receiver for receiving said data burst message; a means to check whether said data burst message is packet data; and a means for forwarding said data burst message to a packet data serving node if said data burst message is packet data; and a packet data serving node, including: a means to reform said data packet wherein said wireless data device can dynamically send said data packet over said dedicated traffic channel.

The present invention still further provides a method for forward link dynamic packet transport from a base station controller to a wireless data device in a CDMA2000 network, said method comprising the steps of: determining a frame transport capability of a forward common channel; checking whether a data packet falls within said frame transport capability; and if said data packet falls within said frame transport capability; encapsulating said data packet as a data burst message; sending said data burst message over said forward common channel; receiving said data burst message at said wireless data device; and reforming said data packet

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is best understood with reference to the drawings, in which:

FIGURE 1 is a schematic view of a wireless device within a CDMA 2000 network;

FIGURE 2 is a flow chart of the steps involved in passing a message along the reverse link;

FIGURE 3 is a decision tree for determining which channel will be used to pass the message; and

FIGURE 4 is a flow chart of the steps involved in passing a message along the forward link.

DETAILED DESCRIPTION OF THE DRAWINGS

Reference is now made to Figure 1. As illustrated, a wireless data device 10 is able to send or receive Packet Data on a Traffic Channel 12 or an Access Channel 14 depending on the packet size. The message is sent using airlink 16 to a base station controller 18. Depending on the message it can then be sent to the packet data serving node 20 from which it can access the Internet 22 or a variety of devices 24, as is known to those skilled in the art.

Reference is now made to Figure 2. In the wireless device 10, an application layer is notified of the serving CMDA 2000 systems access channel and voice Traffic Channel maximum transport capabilities. Before Packet Data is sent the application layer in step 30 checks the network transport capability and in step 32 looks at the packet type in order to decide the packet transport mode. The application layer further checks to see whether the message is an e-mail packet or not in step 34. If it is an e-mail packet the destination e-mail address is included in the Packet Data.

The application layer, in step 36, next creates a Data Burst Message (DMB) if Data Burst Messages are to be used for transmission. The burst type in the DBM is indicated as Packet Data and includes information about whether the packet is an e-mail message.

The Data Burst Message can then be sent to the base station controller 18 using data Traffic Channel 40, dedicated Traffic Channel 42 or reverse Access Channel 44 as is explained in more detail below.

Once the base station controller 18 receives a Data Burst Message on the reverse link, the base station controller checks the burst type in step 50 and if the burst type is Packet Data, the base station controller forwards the Data Burst Message to the packet data serving node (PDSN) 20. The PDSN 20 decapsulates the Data Burst Message and reforms the packet to transport over the Internet 22 in step 52. The PDSN further keeps the originating device's e-mail address and the international mobile station identity (IMSI) mapping table. If the Data Burst Message is an e-mail packet, both the originating and destination e-mail addresses are included in the packet.

As one skilled in the art will realize, the upper layer of a device should implement a retransmission scheme to recover any data packet loss in the airlink. When using Data Burst Messages, the Radio Link Protocol (RLP) is not used, and thus packet loss is possible.

Reference is now made to Figure 3. Before sending Packet Data the application layer on the wireless data device 10 decides the packet transfer mode based upon the network capacity and the packet type.

Upon transmission to the radio link, the device Packet Data state is also checked. In step 60, the application layer checks to see whether a data Traffic Channel is already established. If a data Traffic Channel is already established then a message is always sent in step 62 over the dedicated data Traffic Channel.

If, however, no data Traffic Channel was found to be established in step 60 the application layer moves to step 64. In step 64, the application layer checks whether a dedicated Traffic Channel is established. Such a dedicated Traffic Channel can include a voice traffic channel, but it is not indented to limit the present invention to a voice traffic channel, and any dedicated Traffic Channel could be used.

If a dedicated Traffic Channel is established, the application layer next moves to step 66 in which it checks whether data can be sent on the dedicated channel. If data can be sent on the dedicated channel the application layer moves to step 68 in which the message size is checked to determine whether it is less than the data capability of the dedicated Traffic Channel. If in step 68 it is determined that the message size is less than the data capability then the message is sent over the dedicated Traffic Channel in step 70.

Conversely, if no dedicated Traffic Channel has been established, if data cannot be sent over the dedicated channel, or if the message size is greater than the data capability of the dedicated Traffic Channel, as determined in steps 64, 66 and 68 respectively, the application layer next moves to step 72.

In step 72, the application layer determines whether data can be sent on the reverse access channel. If data can be sent on the reverse access channel, the application layer moves to step 74 in which it checks whether the message size is less than the data capability of the reverse access channel. If the message size is less than the data capability of the reverse access channel, then the message is sent over the reverse access channel in step 76.

If data cannot be sent over the reverse access channel or if the message size is greater than the data capability of the reverse access channel, as determined in step 72 and 74, then the wireless data device establishes a dedicated data Traffic Channel in step 78 and messages are then sent over the dedicated data Traffic Channel.

One skilled in the art will realize that other methods can be used for determining which channel to send the data packets on. This could include using the reverse Access Channel as a preferred channel over the dedicated Traffic Channel. It could further include only checking either the reverse access channel or the dedicated traffic channel, and establishing a data Traffic Channel if that one channel is unavailable to be used. Other possibilities will be apparent to one skilled in the art.

Reference is now made to Figure 4. When PDSN 20 receives a data packet, an application layer is notified of the serving CMDA 2000 system's forward common channel maximum transport capability. Before Packet Data is sent the application layer in step 30 checks the network transport capability and in step 32 looks at the packet type in order to decide the packet transport mode.

The application layer, in step 36, next creates a Data Burst Message (DMB) if Data Burst Messages are to be used for transmission. The burst type in the DBM is indicated as Packet Data.

The Data Burst Message can then be sent through base station controller 18 and to the wireless device 10 using data Traffic Channel 40 or the forward common channel 46 similarly to the method described above for the reverse access channel.

Once the wireless device 10 receives a Data Burst Message on the forward link, the wireless device checks the burst type in step 50 and if the burst type is Packet Data, the wireless device removes the Data Burst header in step 52 and passes the packet to its application layer.

As with the reverse link, one skilled in the art will realize that the upper layer of the PDSN device should implement a retransmission scheme to recover any data packet loss in the airlink because RLP is not used.

The present invention overcomes the disadvantages of the prior art by providing a way to send data traffic without having to establish a dedicated data Traffic Channel. This saves both network resources by not having a dedicated data Traffic Channel and by not requiring the messages needed for the establishment of the dedicated data Traffic Channel. The present invention further saves the battery life of the wireless data device by not requiring the additional messages for establishing a dedicated data Traffic Channel.

The above-described embodiments of the present invention are meant to be illustrative of preferred embodiments and are not intended to limit the scope of the present invention. Also, various modifications, which would be readily apparent to one skilled in the art, are intended to be within the scope of the present invention. The only limitations to the scope of the present invention are set forth in the following claims depended hereto.